

Understanding Cow Size and Efficiency

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Objectives

- Identify the Interrelated Components
 - Define efficiency
 - Industry segmentation conundrum
 - Genetic potential/environment interplay
 - Metabolic weight
- Problem Solving Tools
 - Best measures of efficiency
 - Optimizing breeding and production systems
 - Herd size
- Summary and Conclusions

The Definition of Efficiency

Efficiency

- Ratio of total costs to total animal product (economic equivalents) from females and their progeny over a given period of time.

Dickerson, 1970

- Goal: decrease the ratio

$$\frac{\text{Input}}{\text{Output}}$$

Efficiency

- Ratio of total costs to total animal product (economic equivalents) from females and their progeny over a given period of time.

Dickerson, 1970

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$$\frac{\text{Output}}{\text{Input}}$$

Two Aspects

- Biological efficiency
 - Beef produced to feed consumed
- Economic efficiency
 - Dollars returned to dollars invested

Industry Segmentation Conundrum

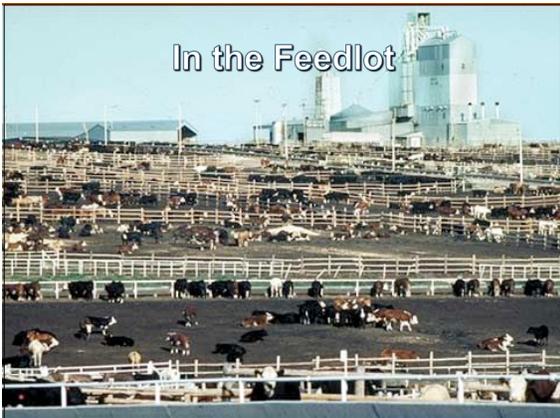
On the Ranch



On the Ranch

- Early sexual maturity
- High rate of reproduction
- Low rates of dystochia
- Longevity
- Minimum maintenance requirements
- Ability to convert available energy into the greatest possible pounds of weaned calves

In the Feedlot



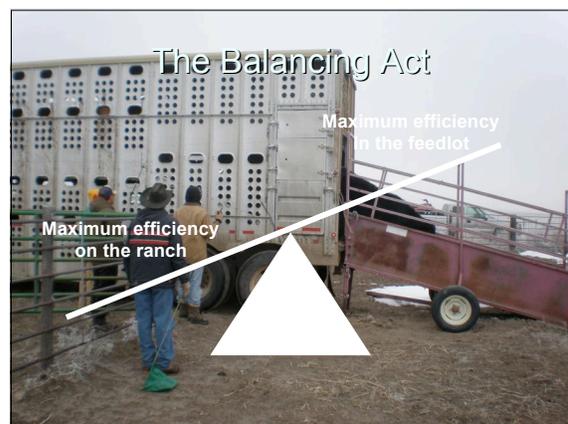
In the Feedlot

- High growth rates
- Later puberty
- Lower propensities to marble
- Heavy mature weights
- Greater visceral mass



Segmentation

<p style="text-align: center;">Ranch</p> <ul style="list-style-type: none"> ■ Limited energy ■ Forage based ■ Environment is variable ■ High investment/unit ■ "Cow Efficiency" 		<p style="text-align: center;">Feedlot</p> <ul style="list-style-type: none"> ■ High energy ■ Grain based ■ Environment is controlled ■ Low investment/unit ■ "Growth Efficiency" 
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Biological traits supporting efficient use of the two resources [grazed forages versus harvested concentrates] are markedly different.

Notter, 2002

- ### Practical Implications
- The ranch and feedlot segments are markedly different environments.
 - Tradeoffs exist between growth and reproductive traits.
 - The tradeoffs are based upon the biology and physiology of cattle.

Food Energy

Biological Efficiency

- Depends upon the interaction between
 - Genetic potential of the animal
 - The environment
 - Availability and variability of feed resources

Order of Energy Partitioning

1. Maintenance } Individual
2. Growth } Individual
3. Lactation } Calf on the ground
4. Reproduction } Calf to come

Maintenance Energy

- High Maintenance**
- High milk production
 - High visceral organ weight
 - High body lean mass
 - Low body fat mass
 - High output
 - High input

Maintenance Energy

- | High Maintenance | Low Maintenance |
|------------------------------|-----------------------------|
| ■ High milk production | ■ Low milk production |
| ■ High visceral organ weight | ■ Low visceral organ weight |
| ■ High body lean mass | ■ Low body lean mass |
| ■ Low body fat mass | ■ High body fat mass |
| ■ High output | ■ Low output |
| ■ High input | ■ Low input |

Maintenance Requirements \neq Efficiency

Why?

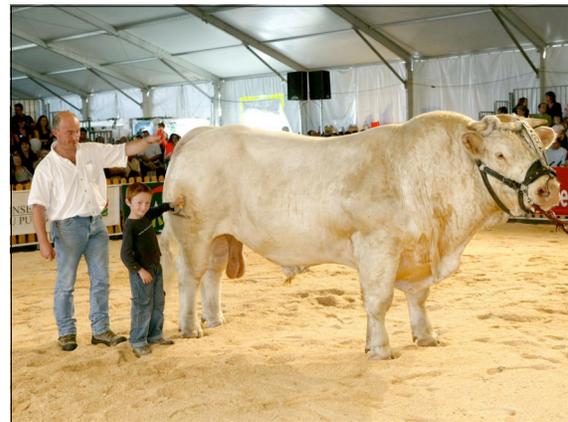
$$\frac{?}{\text{Maintenance Requirements}} = \frac{\text{Output}}{\text{Input}}$$

Practical Implications

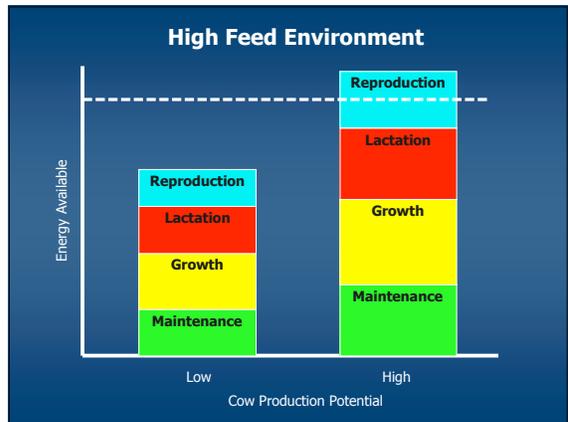
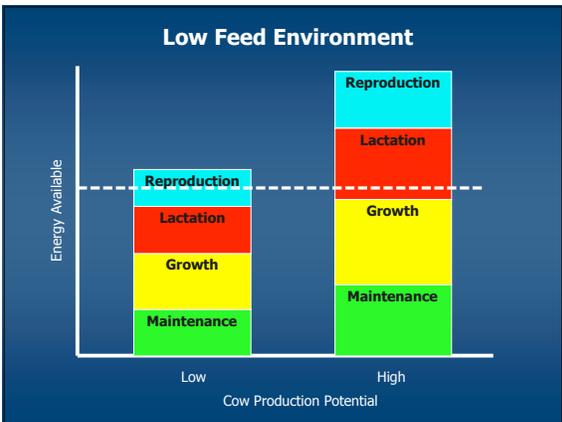
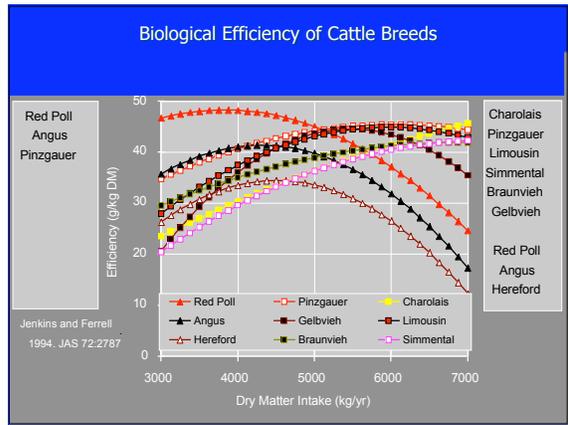
- Low maintenance cows are not necessarily efficient cows.
- High maintenance cows are not necessarily inefficient.
- Maintenance energy alone is not a measure of biological *or* economic efficiency.

The Interplay Between Genetic Potential and the Environment

Genetic Potential Variation



Environmental Variation





Practical Implications

- There is variation in genetic potential.
- There is variation in feed availability.
- Cows with low production potential are more biologically efficient in low feed environments and cows with high production potential are more biologically efficient at high feed environments.

Maintenance Energy and Calf Weight

- We analyzed a 165,000 head database
- As cow maintenance energy EPD increases cow weight increases
- As cow maintenance energy EPD increases calf weight increases
- 12 additional MCal/year in maintenance = 3 additional lbs weaning weight

$$\frac{3 \text{ additional lbs}}{12 \text{ additional Mcal/year}}$$

Adjusted Net Difference Btwn 12 MCal/yr and 3 lbs Weaning Weight

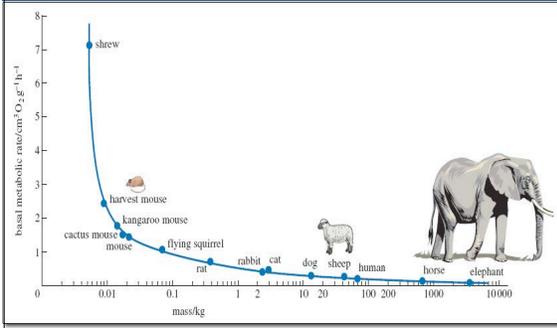


Practical Implications

- The increase in average cow size in the nation is a rational response to inexpensive feed.
- If a cow will get bred in her environment the additional maintenance energy requirements of the larger cow is more than paid for by the additional weight of her calf.

Metabolic Weight

Kleiber's Theory



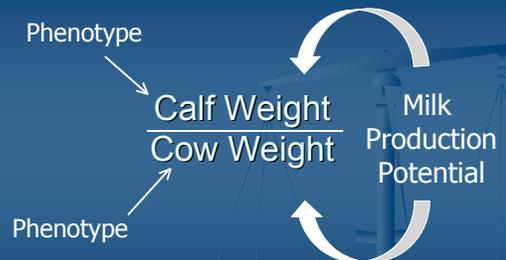
Live Weight	Metabolic Weight	Animal Unit Equivalent (% of 1000 lbs)	Equivalent Herd Size (Baseline: One hundred 1000 lb cows)
800	150	85%	118
850	157	89%	113
900	164	92%	108
950	171	96%	104
1000	178	100%	100
1050	184	104%	96
1100	191	107%	93
1150	197	111%	90
1200	204	115%	87
1250	210	118%	85
1300	216	122%	82
1350	223	125%	80
1400	229	129%	78
1450	235	132%	76
1500	241	136%	74
1550	247	139%	72
1600	253	142%	70

Practical Implications

- The correct adjustment for herd size is based upon metabolic weight.

Problem Solving Tools

Measuring Efficiency



Factors Affecting Feed Intake

- Body Condition Score
- Sex
- State of Production
- Age
- Quality of Forage
- Environmental Stress
 - Temperature
 - Parasites
 - Disease
 - Mud
 - Altitude

Reproduction

Reproduction



Total Pounds Weaned Cows Exposed

Practical implications

- Calf weight/cow weight is not a good measure of efficiency.
Dinkel, 1978; Cartwright, 1979; MacNeil, 2005
- Reproduction is the overriding driver in efficiency and needs to be included in the measure.

Breeding and Production Systems

Problems with Culling for Efficiency

- Long generational intervals
- Small selection differential within a herd
- Culling based on traits that are low in heritability is ineffective
- Compared to bulls, individual cows contribute little to the overall genetic makeup of a calf crop

Bull Selection

Problems with Purebreds

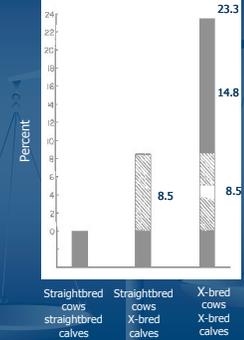
- No breed excels in all traits
- Crossbreeding or composite populations can be used to optimize performance and match genetic potential with:
 - Climate
 - Feed resources
 - Consumer preferences

Crossbreeding

Heterosis

- Heterosis increases production per cow 20 to 25% in *Bos taurus* x *Bos taurus* crosses and at least 50% in *Bos indicus* x *Bos taurus* crosses in subtropical regions
- More than half of this effect is dependent on use of crossbred cows

Weight of Calf Weaned Per Cow Exposed To Breeding



Jenkins, MARC

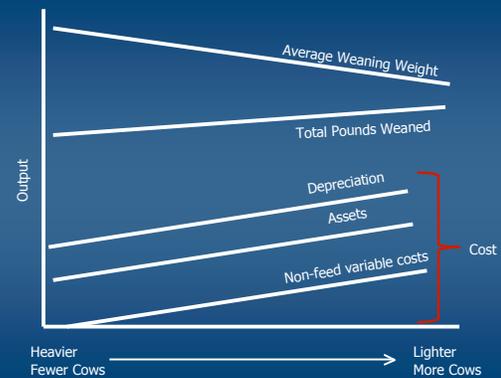
Production System

- Market End Point
 - Sell at weaning
 - Retain ownership
- Product
 - Commercial: \$/pound
 - Seedstock: \$/head

Practical Implications

- Compared to bull selection, culling is an inefficient way to improve efficiency.
- Heterosis is powerful.
- When and what are you selling?

Economic Analysis



Economic Analysis

- \$100/cwt calves. \$4 slide
- Calf weights based on 165,000 cow database
- 20% cull rate. \$0.50/lb
- 1 bull: 25 cows. \$2000/bull
- \$200/acre. 20 acres/Animal Unit (1200 lb cattle)
- \$433.34 fixed cost/head
 - Texas 2008 SPA Data

Economic Analysis Continued

- To calculate net income
 - Fixed costs remained the same
 - Variable feed costs ignored
 - \$40 Non-feed variable cost/head
 - Adjustments
 - Cull cow revenue
 - Depreciation
 - Bulls

Live Weight	Equivalent Herd Size (Baseline: 500 1200 lb cows)	Total Pounds Weaned	Net
1000	573	292,463	\$103,906
1200	500	278,034	\$95,793
1400	445	268,121	\$88,732

Net Income \neq Efficiency

Why?

$$\frac{\text{Net Income}}{?} = \frac{\text{Output}}{\text{Input}}$$

$$\frac{\text{Net Income}}{\text{Assets}} = \text{ROA}$$

Live Weight	Equivalent Herd Size (Baseline: 500 1200 lb cows)	Total Pounds Weaned	Net	ROA	Non-land ROA
1000	573	292,463	\$103,906	0.5%	16%
1200	500	278,034	\$95,793	0.5%	15%
1400	445	268,121	\$88,732	0.4%	15%

Practical Implications

- Extremely Sensitive!
- As long as cow type is within given environmental and economic guardrails, size difference has little impact on profitability.

Wrap Up

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 - Define efficiency
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- Problem Solving Tools
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 - Herd size

Summary

The most efficient cow is the one with the highest milk potential that can, without reducing the percentage of calves successfully weaned, repeatedly produce a calf by bulls with the growth and carcass characteristics valued most in the marketplace.

It is only managers – not nature or laws of economics or governments – that make resources productive.

-Peter Drucker, *Managing in Turbulent Times*

We don't need better cow sizes for our managers, we need better managers for our cow sizes.

Questions?

